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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

VALENROD, YEVGENY

ART UNIT

PAPER NUMBER

1621

NOTIFICATION DATE

DELIVERY MODE

09/08/2008

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspatents@senniger.com

<b>Office Action Summary</b>	<b>Application No.</b> 10/577,374	<b>Applicant(s)</b> SUTTON ET AL.	
	<b>Examiner</b> YEVEGENY VALENROD	<b>Art Unit</b> 1621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 June 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-3,5-7 and 9-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,5-7 and 9-22 is/are rejected.
- 7) ☒ Claim(s) 11 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 April 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                       | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>8/25/08</u> .   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Withdrawn rejections***

Rejection of claim 11 under 35 USC 112 2nd paragraph is withdrawn in view of applicants' remarks.

Rejection of claims 1, 2, 4, 5, 10, 12, 16, 17, 20 and 21 under 35 USC 102(b) over Cooley et al. is withdrawn in view of applicants' amendments.

Rejection of claims 1, 2, 4, 5, 7, 8, 9, 10, 12, 20 and 21 under 35 USC 102(b) over Schwartz et al is withdrawn in view of applicants' amendments.

Rejection of claims 1, 4, 6, 10, 12, 13 and 15 under 35 USC 102(a) over Cockrem et al. is withdrawn in view of applicants amendments.

### ***Objections***

Claims 11 is objected for having improper grammar. Line two of claim 11 reads:

"...heaters are located in the or each...".

### ***Maintained rejections***

*The text of the rejection has been modified to reflect applicants amendments and to address the remarks. Modified portions of the text are underlined.*

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1- 3, 5, 10-12, and 16-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cooley et al. (US 4,032,458) in view of Turner et al (US 4,751,334)

*Scope of prior art*

Cooley et al. disclose a continuous process for production of 1,4-butanediol by supplying maleic acid containing 56.45% water( Column 13, Example 1, lines 63-65) to an esterification zone comprising n-butanol where the butyl ester of maleic acid is produced. Cooley et al describe bringing the reaction mixture to reflux (column 13 line 61), which means that the mixture was heated. In order to advance this reversible reaction, water needs to be removed. Cooley et al. accomplish removal of water via distillation of water-butanol azeotrope (column 11, line 20-23, and Figure on the title page showing esterification/dehydration chamber 10 and stream 15). The produced ester is subjected to catalytic hydrogenation (column 11, line 61-column 12, line 6).

*Ascertaining the difference*

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Cooley et al fail to teach:

- a) Recycling of water to step (a) (claim 3).
- b) Position of the heater for the esterification process (claim 11).
- c) Vapor phase hydrogenation (claim 18).
- d) Recycling of butanol recovered in the hydrogenation (claim 19).

e) Cooley et al. fail to present an example where methanol is utilized in the described process.

*Secondary reference*

Turner et al. teach vapor phase hydrogenolysis of maleic acid esters to produce 1,4-butadiene.

*Obviousness*

Recycling of water:

One of ordinary skill in the art would be motivated to recycle water recovered from the esterification process into the esterification reactor. Doing so reduces the amount of water required for the process and has economic and environmental benefits. Applicant has not indicated any unexpected results arising from using water recovered in the process when compared to using water obtained elsewhere. Recycling of water to any part of the reactor that requires water is therefore obvious absent unexpected results.

Position of the heater in the esterification process:

One of ordinary skill in the art would be motivated to position the heater at any place on the esterification reactor where the heater will perform its designed function

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which is to heat the solution in the reactor. Since the process of Cooley et al. requires a distillation column for azeotropic removal of water-butanol, it is logical to place the heater on the bottom of the reactor where, which is where the reagents are introduced. Applicant has not provided unexpected results that arise as a result of specific heater position. Absent such results, limitation of claim 11 is obvious in view of Cooley et al.

Vapor phase hydrogenation:

Turner et al teach vapor phase hydrogenation and hydrogenolysis of diethyl malonate to produce butane 1-,4-diol (column 1, lines 11-16). They teach that their process provides a method of producing 1,4-butane-diol from the starting materials that are obtained from butane or benzene feedstock through maleic anhydride. In view of Cooley et al and Turner et al applicants' invention is obvious. There is no unexpected result from using vapor phase hydrogenation. In fact Turner et al. describe their process as designed for the very purpose in which applicant uses it. Combining two methodologies where each one serves its intended purpose is obvious absent unexpected results.

In column 6, line 65 - column 7, line 6, Cooley et al teach that the butanol used in the esterification need not be removed prior to hydrogenation of the esters. In hydrogenation butanol can serve as a solvent (although it is not necessary) and disperse heat that is generated by the exothermic hydrogenation process. One of ordinary skill in the art would find it obvious to recover the solvent after the hydrogenation process and reuse it in the esterification reaction. Motivation for recovery of butanol comes from

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environmental and economic concerns. Recovery of butanol is therefore obvious absent unexpected results.

Methanol as the monohydric alcohol:

Although Cooley et al do not exemplify methanol as a monohydric alcohol they do not exclude it from their invention. In column 2, lines 44-57 Cooley describe monohydric alcohol suitable in their invention **include** those having from 2 to 10 carbon atoms, however the language is not limiting and one skilled in the art would find it obvious to use any monohydric alcohol including methanol.

Reply to applicants' remarks:

Applicant argues that using methanol in the invention of Cooley et al is not obvious because methanol does not form an azeotrope with water which makes it unsuitable for azeotropic distillation. Although methanol does not form an azeotrope with water, it is well known to form an azeotrope with acetonitrile and water. One skilled in the art is well aware of the importance of removing water from a fisher esterification reaction, if methanol is used as a monohydric alcohol; it is obvious to add acetonitrile in order to remove water from the reaction mixture.

Turner et al. does not meet all of the limitations of the instantly rejected claims. However, Turner et al is only used here to demonstrate that vapor phase hydrogenation of and hydrogenolysis of dialkyl malonates is known and one would be motivated to utilize the Turner et al process to achieve an expected result.

Claims 1, 2, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schwartz et al. (GB 1,437,898) in view of Cockrem et al. (US 5,210,296).

*Scope of prior art*

Schwartz et al teach a continuous 2-stage process for preparation of a diester of maleic acid. The first stage comprises production of monoesters which are subsequently converted to diesters in the second stage (Example 1 on page 4). The maleic acid for the process is obtained via scrubbing of maleic anhydride with water (page 1, lines 40-50). Water content in the feed is above 50% (page 4, column 1, lines 33-37). Water and alcohol are removed from the esterification zone by azeotropic distillation (page 4, lines 4-7) and esterification zone is heated with an aid of a heater (page 4, lines 89-90).

*Ascertaining the difference*

Schwartz et al fail to teach:

- a) Recycling of water to the maleic anhydride scrubbing process (claim 22).
- b) Use of catalyst in the second step of the process (claim 14).
- c) Schwartz et al. fail to provide an example where methanol is used as a monohydric alcohol.

*Secondary reference*



Cockrem et al teach a method for producing high purity lactate ester by supplying concentrated fermentation broth, adding butanol and sulfuric acid (liquid acid catalyst), heating the reaction to while removing water as an azeotrope with butanol and recovering the ester product (see columns 11-12, Example 1).

*Obviousness*

Recycling of water to the maleic anhydride scrubbing process:

Schwartz et al teach that maleic acid used in their invention is produced via scrubbing maleic anhydride with water in order to produce a crude aqueous solution of maleic acid (page 1, lines 45-50). One of ordinary skill in the art would find it obvious to recycle water that is recovered from production of diesters in order to utilize it in the production maleic acid. Doing so reduces the amount of water required for the process and is therefore more economical and environmentally friendly. Recycling of reagents is common in the art and is therefore obvious absent unexpected results.

Use of catalyst in the second step of the esterification process:

Cockrem et al. teach use of catalyst in esterification process. Catalysts are well known to lower the activation energy of the process and thereby increase production rate. One practicing the process of Schwartz et al. would find it obvious to use a catalyst in first or/and second step of esterification. *Although the process of Cockrem et al. utilize a starting material that is different from Schwartz et al., functional group interconversion is the same, acid to an ester. Because the functional group interconversion is the same one skilled in the art would expect utilization of Cockrems' catalyst in the process of Schwartz et al to be successful.*

*Cockrem et al. also teach concentrating the starting material prior to esterification step (see fig 1 and fig 2). Water is well known to be a reagent in ester hydrolysis and it is common to minimize water in the esterification reaction in order to push the reaction equilibrium to the ester product. One skilled in the art would be motivated to concentrate a mixture of carboxylic acid and water prior to performing the esterification step in order to reduce the reaction duration and amount of alcohol required. Cockrem et al. demonstrate the utility of such a step.*

*Schwartz et al. exemplify n-butanol and n-hexanol as the monohydric alcohol. However their invention is not limited to the 4 and 6 carbon alcohols, alcohols that may be employed include 1 carbon alcohols, which includes methanol. One skilled in the art would find it obvious to select any alcohol that is described by Schwartz et al. as capable of being used in their invention.*

*Reply to Applicants' Remarks:*

*Applicant argues that although the disclosure of Swartz et al. includes temperature and pressure ranges that overlap with those instantly claimed, the working examples fall outside of the scope of the instantly claimed process. One skilled in the art would find it obvious to alter pressure and temperature in order to optimize the reaction conditions. Such limitations alone are therefore not sufficient to overcome the broader teaching of the process, absent unexpected result.*

***Conclusion***

Claims 1-3, 5-7, 9-22 are pending.

Claims 1-3, 5-7 and 9-22 are rejected.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yevgeny Valenrod whose telephone number is 571-272-9049. The examiner can normally be reached on 8:30am-5:00pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Daniel Sullivan can be reached on 571-272-0779. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Yevgeny Valenrod/

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